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EFFECTS OF NEOLIBERAL POLICIES ON INDUSTRIAL AND TECHNOLOGICAL DENSITIES AND ON THE COMPETITIVENESS OF THE STATES OF SOUTHEASTERN BRAZIL: 2000 – 2005

EFEITOS DAS POLÍTICAS NEOLIBERAIS NAS DENSIDADES INDUSTRIAIS, TECNOLÓGICAS E NA COMPETITIVIDADE DOS ESTADOS DO SUDESTE BRASILEIRO: 2000 - 2005

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ABSTRACT

This study analyzes the impact of neoliberal policies on the evolution of industrial and technological densities within the immature innovation systems of Brazil's Southeast Region—specifically São Paulo, Rio de Janeiro, Minas Gerais, and Espírito Santo—between 2000 and 2005. By constructing indicators of industrial and technological density, a comprehensive "Regional Innovation System Maturity Index" (IMSRI) was developed to assess regional competitiveness during a period when neoliberal policies were actively reshaping the economy. The findings indicate a significant decline in industrial densities in Rio de Janeiro and Minas Gerais, resulting in a loss of systemic competitiveness. Conversely, the innovation systems in São Paulo and Espírito Santo showed relative strengthening. Furthermore, the analysis highlights processes of deindustrialization and economic reprimarization within the Southeast region, underscoring the strategic necessity of industrial and technological policies at both federal and state levels to foster sustainable regional development.

Keywords: Industrial and Technological Densities, Regional Innovation Systems, Regional Competitiveness.

RESUMO

O artigo analisa o impacto das políticas neoliberais na evolução das densidades industriais e tecnológicas dos imaturos sistemas de inovação que caracterizam os estados da Região Sudeste brasileira: São Paulo, Rio de Janeiro, Minas Gerais e Espírito Santo. Com base no recorte analítico proposto, constroem-se indicadores de densidade industrial e de densidade tecnológica, a partir dos quais define-se um terceiro indicador de competitividade regional, denominado "Índice de Maturidade de Sistemas Regionais de Inovação" (IMSRI). Tendo em vista as políticas neoliberais implementadas a partir de 1994 no Brasil, avaliam-se os impactos na competitividade de cada um dos estados mencionados — no período 2000-2005 —, fase em que tais políticas estavam a produzir seus resultados. A análise identifica reduções expressivas nas densidades industriais dos estados do Rio de Janeiro e de Minas Gerais, o que se reflete na perda de competitividade sistêmica desses estados, bem como relativos avanços nos sistemas de inovação de São Paulo e do Espírito Santo. Evidenciam-se processos de desindustrialização e reprimarização econômica na região Sudeste, sublinhando a relevância estratégica de políticas industriais e tecnológicas, tanto em âmbito federal quanto estadual, para impulsionar o desenvolvimento regional.

Palavras-chave: Densidades Industriais e Tecnológicas, Sistemas Regionais de Inovação, Competitividade Regional.

INTRODUCTION

Friedrich List, in his work "The National System of Political Economy", originally published in 1841, defends the active role of the State in the design of public policies and economic intervention, aiming at the protection and development of the nascent industry – a fundamental element for the economic development of the Nation. In opposition to English liberal economic thought, whose foundation rests on free trade and individual benefits, List argues that a national economic system should be shaped in line with the specific situation of each nation, with a view to its development, and not the other way around (Oliveira, 2021). In the same vein, Alexander Hamilton[1] uses protectionism in the United States of America in the nineteenth century as a strategy to defend the nascent industry in order to promote the progress and development of the American nation.

Influenced by the national developmentalist ideology, Brazil adopted industrialization by import substitution as a development strategy in the period from 1930 to 1980. Industrialization as a development policy began in the government of Getúlio Vargas, from 1930 onwards, going through different stages until the consolidation of the basic industry in the 1950s and the manufacturing industry — focused on durable and semi-durable consumer goods — in the 1970s.

1 In a critical view of the classical doctrine of English free trade, Hamilton argues that this logic benefited the industrialized countries. Developing countries, such as the USA in the first half of the nineteenth century, should protect their industries until they acquire scale and conditions to compete in the international market (Lazzaretti and Rohenkohl, 2019).

The effort paid off for the country! According to Oreiro (2022), it is estimated that the real rate (annual average) of growth of the Brazilian GDP between 1930 and 1980 was 7% per year, while the per capita income grew between 3.7% and 4% per year.

From the territorial point of view, industrialization benefited mostly the Southeast Region of Brazil, especially the states of Rio de Janeiro, São Paulo, and Minas Gerais. Even under the aegis of neoliberal policies, the Gross Domestic Product (GDP) of the Southeast represented 56.5% of the national GDP, and the Industrial Transformation Value (VTI) of the region represented 63.5% of the national VTI in 2005 (IBGE, 2007).

In turn, the neoliberal political agendas that guided the two governments of Fernando Henrique Cardoso (1995 to 2003) were based on the perception that the model of industrialization by import substitution, with the intervention of the State, was exhausted. From this perspective, reforms based on the "Washington Consensus", such as the opening of the economy, monetary stabilization, privatizations and deregulation of the State, should be implemented in Brazil, as they were. Such reforms had as fundamental assumptions to shift the role of the Brazilian State from intervenor to regulator, to promote its "modernization" and consolidate the so-called economic foundations on neoliberal bases, in which the market would become the main inducer of economic growth, replacing the State and planning. Implemented systematically in Brazil from 1994 onwards, neoliberal reforms will more directly affect the productive dynamics of the country's most industrialized region, the Southeast.

In the 2000s, empirical evidence regarding Brazilian industrial production drew attention to the occurrence of a probable process of deindustrialization, favored by a perverse combination of variables such as financial openness, appreciation of the terms of trade, and appreciated exchange rate (Oreiro and Feijó, 2010; Bresser Pereira and Marconi, 2008). According to these authors, Brazil would be resuming its historical tradition of producing and exporting *commodities*, going against the industrialization policies that guided the country's economic growth model between 1930 and 1980 (Bresser Pereira and Marconi, 2008).

In turn, the effects of neoliberal policies occur in the midst of the changes that occurred in the production process from 1970 onwards, which occurred simultaneously with the emergence of new technological paradigms such as microelectronics, biotechnology, and science focused on the production of new materials. These changes imply that productive activities, typically centered on the processing of natural raw materials and the production of material goods, become knowledge- and information-intensive activities. (Acs et al., 2000:38; Santos et al., 2002:7; Dolourex and Parto, 2007).

The new technological paradigms and the rise of neoliberalism as a mode of regulation of contemporary capitalism have imposed restrictions on the ability of national states to intervene in their economies. From the 1980s onwards, the subnational spheres – regions and localities – gained a leading role in the design and implementation of industrial and S&T and R&D policies, playing a key role in economic and social development. In recent local and regional dynamics, knowledge and technological innovation are perceived as crucial. In this scenario, the industry remains extremely relevant for economic development. To be competitive, it needs to be territorially located and organized in the form of agglomerations or "industrial clusters". Industrial clusters need to be permeated by institutions that favor technological innovation and knowledge, notably S&T and R&D institutions. To account for the transformations that shape contemporary capitalism, new theoretical approaches have emerged, among them, the framework of Regional Innovation Systems stands out (Dolourex and Parto, 2007).

This article aims to analyze the impact of neoliberal policies implemented in Brazil from 1994 onwards on the evolution of industrial and technological densities in the states of São Paulo, Rio de Janeiro, Minas Gerais, and Espírito Santo, which are taken as a *proxy* for defining the degree of robustness and competitiveness of these immature innovation systems. Based on the theoretical framework of SRI and the proposed analytical approach, indicators of industrial density and technological density are constructed, from which a third indicator of regional competitiveness is defined, here defined as "Maturity Index of Regional Innovation Systems (IMSRI)".

The period of analysis covers the years 2000 and seeks to cover the maturation phase of neoliberal policies adopted from 1994 onwards, including the FHC 1 and 2 governments (1995-2002) and the beginning of the Lula 1 government (2003-2006).

The methodology developed is based on the approach of Regional Innovation Systems, as defined by Mothe and Paquet (1998); on the *Technology Achievement Index* (TAI), proposed by Desai et al. (2002), and on Rocha and Ferreira (2004) and Rosendo (2008). The analysis of industrial and technological densities, as well as the determination of the competitiveness of the states of the Brazilian Southeast, is mainly based on data produced by the Brazilian Institute of Geography and Statistics (IBGE) from the Annual Industrial Survey (PIA) and the Technological Innovation Survey (PINTEC); by the Ministry of Science, Technology and Innovation (MCTI) and by the National Institute of Industrial Property (INPI).

The work is structured as follows: after this introduction, section 2 presents the theoretical-methodological framework, succinctly addressing the perspective of Regional Innovation Systems and developing the framework for the analysis of industrial and technological densities, in addition to the construction of the regional competitiveness indicator, called "Maturity Index of Regional Innovation Systems". Section 3 is dedicated to the analysis of the industrial density of the states of the Southeast, while section 4 focuses on the technological density. Section 5 evaluates the competitiveness of each of the four states in the region, using the Regional Innovation Systems Maturity Index. Finally, the final considerations are presented.

REGIONAL INNOVATION SYSTEMS - THEORETICAL AND METHODOLOGICAL FRAMEWORK

As Philip Cooke (1988) proposes, "*today, the number one factor for competitive advantage is innovation".* The author points out that, because of changes in global economic relations, the rise of East Asian economies and the decline of Fordism as an industrial model and, more broadly, as a model of social regulation, new approaches to the analysis of competitive advantage, based on innovative capacity, have emerged. "Among the most challenging are the efforts to forge an *innovation system* to support the competitiveness of business on a regional scale" (Cooke, 1998, p.2).

Charles Edquist (1997) reports that, in the early 1990s, two main books were released that constituted the framework of the Innovation Systems approach: "The first was edited by Bengt-Åke Lundvall (1992): 'National Systems of Innovation: Toward a Theory of Innovation and Interactive Learning'" and the second was edited by Richard Nelson (1993): 'National Systems of Innovation: A Comparative Study'.

Despite the important contributions to the innovation process at the national level, the National Innovation Systems (SNI) approach presented methodological problems when applied to the analysis of real innovation systems. The empirical finding of the approach was limited to the observation of some measurable variables, namely: on the one hand, the investments of nations in the consolidation of networks that combine teaching and research and, on the other hand, the participation of investments by public and private companies in the development of research in institutes and laboratories specialized in R&D. Richard Nelson's (1993) conclusions that there was no single representative model of a "National Innovation System" made it extremely difficult to carry out the research effort to account for all the complexity of the systemic dimension inherent in the SNI hypotheses. The methodological problems of this approach were added to the observation that regions, to the detriment of nation-states, assumed the role of *locus* of the innovation and competitiveness process (Rosendo, 2008).

The methodological difficulties related to the use of the NIS approach as an analytical instrument and the evidence that regions assumed a more dynamic role in the innovation and competitiveness process resulted in new theoretical and methodological perspectives focusing on the regional and local dimensions. According to Cooke, in the early 1990s, *"regional scientists began to integrate elements of research that had been worked on separately, such as the existence of regionalized technological complexes (Saxenian, 1994) and large-scale productive arrangements such as technopolis" (Cooke, 1998, p.2).*

The studies carried out led to the following question: would there be a specific type of innovation phenomenon at the regional level, systemic or not? According to Philip Cooke, "*the answers to this more general question were driven from the following literatures, namely: post-Fordism (Amin 1994), industrial clusters (Porter, 1990) and the rise of the nation-state (Ohmae, 1993, 1995)"* (Cooke, 1998, p. 3). These studies were based on the consensus that classical Fordism would no longer be the dominant paradigm of social and economic coordination and were fundamental for the construction of the Regional Innovation Systems approach.

However, the discussion about technological change in low- and middle-developed countries has raised questions about the existence, or not, of innovation systems, whether at the national, regional, local, or sectoral levels. Albuquerque (1999), for example, considers that, in some countries, it is possible to identify immature innovation systems and subsystems, respectively at the national and regional levels.

Oinas and Malecki (1999) classify immature innovation systems and subsystems as "technology adapters". According to these authors, one of the main characteristics of technology adapter systems is the fact that they have industrial agglomerations with low density in their intra-regional and extra-regional networks, which hinders the capacity for technological innovation in these places, as well as the efficient adaptation of technology (Oinas and Malecki, 1999:22). Santos et al. (2002) consider that "immature innovation systems" contrast with "local innovative systems", especially concerning the *Modus operandi* of the latter, which is essentially cooperative and allows the insertion of small enterprises. "That is to say, cooperation involves coordination *ex-ante* (qualitative and quantitative) of the plans of small and medium-sized enterprises (SMEs)" (Santos et al., 2002:11).

Recently, researchers in the field of innovation and regional scientists have established a broad debate on the criteria to define in which situation a given region could be characterized as a local or regional innovation system. Researchers have created broader indices to classify countries and regions with low or medium development, due to concerns about incomplete innovation systems.

In view of the context presented above, efforts have been made to develop indicators of regional innovative capacity. Among these indicators, the Technology Achievement Index (TAI) stands out. Prepared by the United Nations Development Program (UNDP) and published in the Human Development Report, originally proposed by Desai et al. (2002). The TAI, translated in Brazil as the Technological Achievement Index, was calculated for 72 low, medium and high development countries (Rocha and Ferreira, 2004). It is a composite index that integrates four dimensions of extreme relevance to a country's scientific and technological policy, namely: a) creation of technologies; b) diffusion of new technologies; c) diffusion of old technologies; and d) human abilities (Rocha and Ferreira, 2004; Archibuigi and Coco, 2002). As Archibuigi and Coco propose, in the same vein, other indices were developed, such as "the Technology Index of the World Economic Forum's Global Competitiveness Report (WEF, 2002) and the critical analysis carried out by Sanjaya Lall (2001b), and the Index of Technological Effort developed by Lall and Albaladejo (2001) for UNIDO" (Archibuigi and Coco, 2002).

However, despite advances in incorporating the technological variable into the most recent theoretical and methodological approaches, it is noteworthy that studies aimed at constructing indicators that define local and regional competencies in Science, Technology, and Innovation, although fundamental, remain insufficient for developing an analytical and classificatory model representative of these systems. The models mentioned do not, for example, account for indicators of industrial performance at the regional level, nor do they define the relative participation of institutions in the processes of innovation and regional competitiveness. Therefore, they omit two crucial elements that define the theoretical framework of Innovation Systems: the tendency toward the spatial agglomeration of industrial activities (responsible for the formation of industrial clusters of various types) and the role of institutions in strengthening productive and innovative capacities. (Rosendo, 2008).

Based on the TAI and the adaptation proposed by Rocha and Ferreira (2004) for the classification of the technological performance of selected Brazilian states, the methodological approach is defined as the Regional Innovation Systems Maturity Index (IMSRI). This index includes indicators of industrial and technological density and seeks to bring the analytical model closer to the theoretical framework of Regional Innovation Systems by Rosendo (2008).

METHODOLOGICAL APPROACH - INDUSTRIAL DENSITY, TECHNOLOGICAL DENSITY AND COMPETITIVENESS/MATURITY INDEX OF REGIONAL INNOVATION SYSTEMS (IMSRI)

Following the methodology proposed in the IAT by Desai et al. (2002) and the adaptation made in the work of Rocha and Ferreira (2004), the Regional Innovation Systems Maturity Index (IMSRI) ranges from 0 to 1. In turn, based on Rosendo (2008), the IMSRI architecture is defined through the composition of two main indices called: Industrial Density Vector (VDI) and Technological Density Vector (VDT). The Industrial Density Vector consists of four dimensions that measure, respectively, the level of investments, physical production, the level of exports, and the productive diversity of the industry of each state analyzed. In turn, each dimension employs one or more proxy indicators. Likewise, the Technological Density Vector (VDT) is composed of four dimensions that seek to measure the technological, scientific, and innovation capabilities of each state analyzed. In the same perspective, each dimension of the VDT has one or more proxy indicators.

Chart 1 presents the structure for calculating the Industrial Density Vector, based on dimensions A, B, C, and D and their respective proxy indicators*:* A1, A2; B1, B2, B3; C1, and D1.

(A) Participation of Companies – aims to evaluate the participation of companies in the generation of income and employment in each state analyzed. Thus, the *proxy* indicators proposed for this dimension are:

(A1) Persons Employed in Industry as a proportion of the Economically Active Population (PO/PEA);

(A2) Industry wage bill as a proportion of state GDP (MS/GDP).

Table 1 | Industrial Density Vector: Dimensions and proxy indicators

A- PARTICIPATION OF COMPANIES
A1- Persons employed in the state's industry as a proportion of the state EAP
A2- State industry wage bill as a proportion of state GDP
B-INDUSTRIAL PRODUCTION
B1-Industrial Transformation Value of the state as a proportion of the state's GDP
B2- Productivity (Industrial transformation value of the state as a proportion of the employed population of the state
B3- Industrial Transformation Value of the state as a proportion of the National Industrial Transformation Value
C-EXPORTS
C1- Exports of industrial products from the state as a proportion of the state's GDP
D- PRODUCTIVE DIVERSIFICATION
D1- Relative participation of the Industrial Transformation Value of the three largest sectors of the state's economy, as a proportion of the total VTI of the state's industry.

Source: Elaborated by the authors based on Desai et al. (2002) and Rocha and Ferreira (2004).

(*) A, B, C, D – Dimensions. (**) A1, A2, B1, B2, B3, C1, D1 – Proxy Indicators

(B) Industrial Production - its purpose is to evaluate the wealth generated by the industry of the state analyzed, as well as its productivity. The *proxy* indicators for this dimension are as follows:

(B1) State Industrial Transformation Value as a proportion of state GDP (VTIe/PIBe);

(B2) Labor productivity in industry expressed by the ratio between the state's Industrial Transformation Value and the state's Employed Persons in Industry (VTIe/POe);

(B3) Industrial Transformation Value of the state as a proportion of the National Industrial Transformation Value (VTIe/VTIn)

(C) Exports – their purpose is to indicate the share of exports of the state industry in relation to the wealth produced in the state. The *proxy indicator* for this dimension is (C1) Export of Industrial Products of the state as a proportion of the state GDP (EXe/GDP).

(D) Productive Diversification - aims to identify the degree of productive diversification of the industry in the analyzed state. Thus, the greater the industrial concentration, the less diversified the industry will be. The proxy indicator of this dimension is:

D1- The *proxy indicator* for this dimension is $(S3/VTIe)^{-1}$ in which S3 corresponds to the sum of the Industrial Transformation Values of the three largest industrial sectors of the state analyzed, divided by the total VTI of the industry of that state, raised to the power -1. This formulation indicates that the "lower" the industrial concentration in the state, the "greater" the impact of this dimension on its industrial density.

Chart 2 presents the structure for calculating the Technological Density Vector, based on dimensions A, B, C, and D and their respective proxy indicators: A1, A2; B1, B2; C1, C2; D1, D2.

Chart 2 | Technological Density Vector: Dimensions and *proxy indicators*

Technological Density Vector
A-Government Participation
A1- Per capita *government expenditure* (Federal and State) on Science and Technology **A2**- Percentage of state revenue spent on Science and Technology
B-Private Sector Participation
B1- Private sector expenditure on innovation as a proportion of net sales revenue **B2-** Companies that have made innovations in relation to the total number of companies
C- Scientific and Technological Production
C1- Articles: percentage of articles published by residents of the state and indexed by the Institute for Scientific Information (ISI) in relation to the total number of Brazilian articles. **C2-** percentage of patents filed by state residents with the National Institute of Intellectual Property (INPI) in relation to the total number of patents filed by Brazilians
D-Base Educational and Skilled Human Resources
D-1- Researchers per million researchers in the state **D-2**- Higher education and postgraduate personnel involved in innovation activity in companies as a proportion of the number of workers employed in the industry.

Source: Elaboration by the authors based on Desai et al. (2002) and Rocha and Ferreira (2004)

(*)A, B, C, D: dimensions. (**) A1, A2, B1, B2, C1, C2, D1, D2 – Proxy Indicators

Dimension (A) - Government Participation in Science and Technology Activities - This dimension aims to define the effort of the federal and state governments with regard to spending on Science and Technology and Research and Development activities carried out in the state under analysis. The *proxy* indicators representing this dimension are the following:

A1- Per *capita* government expenditure (federal and state) in Science and Technology defined by (**Ge + Gf/population**), where Ge = State government expenditures and Gf = federal government expenditures;

A2- Percentage of the state's revenue spent on Science and Technology. Defined by **Ge (C&T) / Rect. (e),** where Ge (S&T) = State expenditure on Science and Technology and Rect (e) = State revenue (R$ per inhabitant).

Dimension (B) - Participation of the private sector in innovation activities - This dimension aims to define the innovation effort of the private sector in the context of the state analyzed. The *proxy* indicators used for this dimension are as follows:

B1-Expenditures made by innovative companies in innovative activities in relation to the industry's net sales revenue. Defined by **(Dei/Rlv),** where Dei **=** Expenditure made by innovative companies and Rlv = Net sales revenue;

B2- Companies that have made innovations in relation to the total number of companies. Defined by **Eri/Et,** where Eri- companies that have carried out innovations and Et= total companies.

Dimension (C) - Scientific and Technological Production - This dimension aims to define the effort of scientific and technological production in the states analyzed. The *proxy* indicators selected for this Dimension are the following:

C1- Articles: percentage of articles published by residents of the state and indexed by the Institute for Scientific Information (ISI) in relation to the total number of Brazilian articles. Defined by **Art.(e)/Art. (BR),** where Art.(e) = articles published by residents of the state and Art. (BR). Br = total number of Brazilian articles indexed in the ISI;

C2 - percentage of patents filed by state residents with the National Institute of Intellectual Property (INPI) in relation to the total number of patents filed by Brazilians. Defined by **Pat (e)/Pat. (Br), where** Pat (e) = patents of state residents and Pat (BR) = total patents filed by Brazilians.

Dimension (D) – Educational Base and Qualified Human Resources – This Dimension aims to evaluate the effort of each of the states analyzed concerning the training of researchers, as well as qualified personnel to work in innovation activities in companies. Proxy Indicators:

D-1- Researchers per million people in the state. Defined by **(Research/1,000,000),** where Researches = number of researchers;

D-2- Higher education personnel (including postgraduates) involved in innovation activities in companies, such as the proportion of workers employed in industry. Defined by P.N.S/ P.O.I., where P.N.S. = Higher Education Personnel and P.O. I = Personnel Employed in Industry.

After the calculations of the proxy indicators to define the four dimensions of each of the four states of the Brazilian Southeast, the TAI (*Technology Achievement Index) formula is applied to obtain the Indicator Index, which ranges from 0 to 1.*

a) Indicator index – obtained from the calculation formula of the *Technology Achievement Index*, TAI-UNDP, adapted to the indicators that represent the dimensions of the state innovation system: II*ij* = X*ij* – X*ijmi* / (X*ijma* – X*ijmi*); where: *i* refers to each of the 4 indicators; and *j* refers to each of the states to be analyzed: São Paulo, Rio de Janeiro, Minas Gerais and Espírito Santo); II*ij* is the index indicator i for state j; X*ij* corresponds to the observed value of indicator *i* for state *j*; X*ijmi* refers to the minimum observed value of indicator *i* for state *j*; X*ij* ma corresponds to the maximum observed value of indicator *i* for state *j*. The values thus obtained vary between "zero" (0) and "one" (1), with "one" corresponding to the best relative situation of the state for that specific indicator and "zero" corresponding to the worst relative situation. In other words, the indices serve as a parameter to identify the relative position of each state in relation to the others, with regard to each specific indicator.

b) Synthetic dimension index – corresponds to the average of the dimension indicator indices in each state. It acts as a measure to compare the state's position with others on that dimension. It is defined by IS*uj* = X (II*ij)* where: IS*uj* is the synthetic index of the dimension *u* for the state *j;* X (II*ij*) corresponds to the average of the indices indicating the dimension *u* for state *j;*

c) The vectors of technological density and industrial density are general indices that correspond to the average of the synthetic indices of each dimension. They enable the general characterization and ordering of indicators related to the state system of science, technology, and innovation, as well as the density or industrial robustness of each state. The higher the values of the Technological Density and

Industrial Density Indexes, that is, the closer they are to (1), the more favorable the position of the state's innovation system in relation to the others. In terms of rating, the Technology Density Index and the Industrial Density Index are defined, respectively, as RTI = M(ISuj) and IDI = M(ISuj).

d) Regional Innovation Systems Maturity Index (IMSR) - It is considered that the Technological Density Vector has the same weight as the Industrial Density Vector in the composition of the IMSR. That is, the IMSRI is calculated from the simple arithmetic mean of the Technological Density and Industrial Density vectors: IMSRI = VDI + VDT/2. The IMSRI ranges from 0 to 1, and the closer it is to 1, the more mature and competitive the system/state analyzed will be

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Table 1 presents the calculations of each of the *proxy* indicators of the four dimensions. The dimensions are: (1) Participation of companies; (2) Industrial production; (3) Exports and (4) Productive Diversification.

Table 1 | Industrial indicators of the states of Southeast Brazil in 2000 and 2005.

States	Industrial Density Vector Dimensions for the Year (2000)						
	Business participation (1)		Industrial Production (2)			Exports (3)	Productive Diversification (4)
	POi/PEA	MSi/PIBe	VTIe/PIBe	VTIe/POi R$1.000	VTIe/VTIn	EXi/PIBe	$(S3/VTI)^{-1}$
São Paulo	10,6%	7,9%	30,7%	56,5	44,8%	10,4%	2,56
Rio de Janeiro	5,0%	3,4%	17,5%	69,1	9,48%	2,6%	1,96
Minas Gerais	5,9%	4,34	22,8%	44,3	9,53%	12,4%	2,27
Holy Spirit	4,9%	3,5%	23,7%	63,7	2,0%	25,3%	1,53
States	**Industrial Density Vector Dimensions for the Year (2005)**						
	Business participation (1)		**Industrial Production (2)**			**Exports (3)**	**Productive Diversification (4)**
	POi/PEA	**MSe/PIBe**	**VTIe/PIBe**	**VTIe/POi R$1.000**	**VTIe/VTIn**	**EXi/PIBe**	$(S3/VTI)^{-1}$
São Paulo	11,6%	6,9%	28,3%	88,7	40,21%	12,2%	2,45
Rio de Janeiro	5,03%	3,7%	21,7%	146,5	10,46%	7,8%	1,61
Minas Gerais	6,9%	4,5%	27,7%	78,9	10,41%	4,8%	1,73
Holy Spirit	5,7%	3,1%	26,3%	123,2	2,43%	20,3%	1,48

Source: Prepared by the authors based on *Desai et al. (2002) and Rosendo (2008), using data from PIA/IBGE, IPEADATA, MCT-Ministry of Science and Technology, MDIC- Ministry of Development and Commerce. Acronyms: 1-PO* Population Employed in the State's Industry; 2- PEA- Economically Employed Population in the State; 3-MS-Wage Bill of the State's Industry; 4-PIBe- Gross Domestic Product of the State; 5- VTIe- Industrial Transformation Value of the state; 6- ITVe -

value of industrial transformation of the state; 7-VTIn- Value of National Industrial Transformation; 8-EXi- Exports of the state's industry; 9-S3 – Three largest sectors of the state industry (values converted into reais by the commercial dollar exchange rate – purchase value – of December 31, 2000 and 2005); Productive diversification DP =[∑ (Si/VTIe)]$^{-1}$ and Si= sectors, i= 1, 2, 3.

The results allow a systematic comparison of the structure, relative participation, and evolution of the variables selected for the industry of each of the states analyzed, in the years 2000 and 2005.

In the analysis of Table 1, the asymmetry observed in the position occupied by the industry of São Paulo in relation to those of the other states of the Southeast stands out. Except for the proxy indicator (VTIe/POi), which measures the productivity of the industry, and the proxy indicator (EXi/PIBe), which measures the percentage exported by the industry in relation to the state GDP, both of Dimension 2 - Participation of enterprises, São Paulo surpasses the other states in all other *proxy indicators* in the years 2000 and 2005, with a wide difference.

In relation to Dimension 2 – Industrial Production, it is noteworthy that, in the year 2000, the participation of the Industrial Transformation Value (VTI) of São Paulo in the national total (*proxy indicator* VTIe/VTIn) was 44.8%, compared to 9.48% in Rio de Janeiro, 9.53% in Minas Gerais, and 2% in Espírito Santo. However, there was a reduction in this indicator for the state of São Paulo in 2005, with the participation falling from 44.8% (2000) to 40.21% (2005). This drop represents a loss of approximately 10% in the relative contribution of the São Paulo VTI to the national VTI, indicating the occurrence of a deindustrialization process. This phenomenon tends to result from phenomena such as industrial deconcentration — characterized by the geographic dispersion of industry to other states, inside or outside the Southeast region — and reduction of companies in the industry, resulting from bankruptcies or mergers, with emphasis on small and medium-sized companies in the traditional sector.

In the period between 2000 and 2005, in parallel with the consolidation of a robust, diversified, and dynamic manufacturing industry, the state of São Paulo expanded its agro-industrial complex, with emphasis on the production and export of sugar, ethanol, orange juice, soybeans, and beef. Analyzing the productive structure of the states of Rio de Janeiro, Minas Gerais, and Espírito Santo, it is verified, in the same period, the protagonism of the mineral extractive industry and the competitive agroindustry. In this sense, **Rio de Janeiro** consolidated its position as the main oil producer in the country, driven by exploration in the Campos Basin, responsible for about 80% of national production in the period. Espírito **Santo showed significant advances in the extractive industry, notably oil, natural gas, and iron ore. At**

the same time, it consolidated a competitive and diversified agro-export complex, with emphasis on the production of coffee (conilon and arabica), cellulose, papaya, black pepper and ginger. Minas Gerais stood out for the mineral extractive industry, being among the world's largest producers of iron ore. It also strengthened an agro-export sector focused on coffee, beef, pork, and dairy production.

The analysis of the four states of the Southeast region, based on Table 1, shows the increase in industrial concentration between 2000 and 2005, according to Dimension 4 – productive diversification. The states that recorded the highest increases in industrial concentration were Minas Gerais (23.7%), São Paulo (21.4%), Rio de Janeiro (9.17%) and Espírito Santo (3.1%). In this sense, the scenario in Rio de Janeiro stands out as emblematic, since in 2000 the oil and gas sector (exploration, production and refining) accounted for 21.24% of the state's Industrial Transformation Value, having increased its contribution to 31.6% in 2005 (Rosendo, 2008, p.74).

Regarding Dimension 2 – Industrial Production, it is observed that, in the period from 2000 to 2005, Rio de Janeiro, Minas Gerais, and Espírito Santo showed an increase in the three *proxy indicators* that define this dimension. This result indicates that the extractive industry and agroindustry boosted the economic dynamics of these states, surpassing the traditional manufacturing industry. This refers to the occurrence of processes of deindustrialization and reprimarization in these state economies.

Based on the data in Table 1, the Technology *Achievement Index* (TAI) methodology is applied to determine the industrial densities of the states of the Brazilian Southeast region in the years 2000 and 2005, as detailed in Table 2. The indicator and synthetic indices were used to define the relative position of each federative unit in each of the four dimensions of the index.

The average of the synthetic indices makes it possible to construct the Industrial Density Vector (VDI) for each federation unit, allowing for marking its relative position in the context of the Southeast region. As outlined in section 1, this indicator oscillates between 0 and 1, with values close to the unit denoting greater industrial density, operating as a *proxy* for production capacity and state competitiveness.

When analyzing the VDI ranking between 2000 and 2005, it is possible to verify the consolidated leadership of São Paulo, which shows an increase in its industrial density in the period. On the other hand, the performance of Rio de Janeiro stands out, which occupies the fourth position in 2000 and maintains it in 2005. The deterioration of this indicator in Rio de Janeiro in the 2000-2005 interval, reducing from 0.205 to 0.194, suggests deep structural problems that compromise the dynamism of its industry.

Table 2 | Indicator, Synthetic Index and Industrial Density Vector for the states of the Southeast Region of Brazil for the years 2000 and 2005

STATES	Indicator, Synthetic and Vector Industrial Density Index - states of the Brazilian Southeast - Year 2000.												
	Business Participation Dimension			Industrial Production Dimension				Dimension Exports		Dimension Productive Diversification		Industrial Density Vector	
	Indicator Index		Table of contents Synthetic	Indicator Index			Table of contents Synthetic	Indicator Index	Table of contents Synthetic	Indicator Index	Table of contents Synthetic		
	PO / PEA	MS / PIB		VTI / PIB	VTI / PO	VTIe / VTIn		EXP / PIB		S3 / VTI		VDI	RANKING
São Paulo	1,000	1,000	**1,000**	1,000	0,471	1,000	**0,824**	0,343	**0,343**	1,000	**1,000**	0,792	**1st**
Rio de Janeiro	0,017	0,000	**0,009**	0,000	1,000	0,175	**0,392**	0,000	**0,000**	0,417	**0,417**	0,205	**4th**
Minas Gerais	0,175	0,200	**0,187**	0,401	0,000	0,176	**0,192**	0,431	**0,431**	0,718	**0,718**	0,382	**2nd**
Holy Spirit	0,000	0,022	0,001	0,469	0,782	0,000	**0,417**	1,000	**1,000**	0,000	**0,000**	0,355	**3rd**
STATES	Indicator, Synthetic and Vector Industrial Density Index - states of Southeast Brazil - Year 2005												
	Participation of Companies			Industrial Production				Exports		Productive Diversification		Industrial Density Vector	
	Indicator Index		Table of contents Synthetic	Indicator Index			Table of contents Synthetic	Indicator Index	Table of contents Synthetic	Indicator Index	Table of contents Synthetic		
	PO / PEA	MS / PIB		VTIe / PIB	VTI / PO	VTI e / VTIn		EXPe / PIBe		S3 / VTI		VDI	RANKING
São Paulo	1,000	1,000	1,000	1,00	0,144	1,000	**0,715**	0,477	**0,477**	1,000	**1,000**	0,798	**1st**
Rio de Janeiro	0,000	0,158	**0,079**	0,000	1,000	0,213	**0,404**	0,193	**0,194**	0,100	**0,100**	0,194	**4th**
Minas Gerais	0,287	0,368	**0,328**	0,909	0,000	0,211	**0,373**	0,000	**0,000**	0,250	**0,250**	0,238	**3rd**
Holy Spirit	0,101	0,000	**0,051**	0,696	0,655	0,000	**0,450**	1,000	**1,000**	0,000	**0,000**	0,375	**2nd**

Source: Prepared by the authors based on data from IBGE-PIA and IPEADATA.

Notes: PO: personnel employed in industry; EAP: economically active population; VTIe: state industrial transformation value; VTIn: value of national industrial transformation; MS: industrial wage bill; GDP: state gross domestic product; EXPe: state exports; S3: industry concentration index, where DP = [∑ (Si/VTIe)]-1 and Si = sectors, i = 1, 2, 3.

In turn, Minas Gerais shows the greatest loss of industrial density in the period, regressing from second to third position, which also denotes structural problems in its industry. In an upward movement, the state of Espírito Santo jumped from third place in 2000 to second in 2005, surpassing Minas Gerais and positioning itself ahead of Rio de Janeiro in the hierarchy of industrial competitiveness in the region. The rise of Espírito Santo to the second position in the hierarchy of industrial density in the Southeast, in the period from 2000 to 2005, shows a trajectory associated with the diversification and productive and technological dynamism of its agro-industrial and mineral extractive sectors.

Analyzing Table 3, which presents the variation of the Industrial Density Vector (VDI) in the states of the Southeast between 2000 and 2005, a discrepant dynamic can be observed: São Paulo and Espírito Santo show increases in their respective VDIs of 0.75% and 5.63%, while Minas Gerais and Rio de Janeiro face significant decreases[2] of 37.7% and 13.39%, respectively.

Table 3 | Percentage Change of the Industrial Density Vector for the states Southeast Region of Brazil - 2000 and 2005

States	Industrial Density Vector 2000		Industrial Density Vector 2005		Industrial Density Variation
	VDI	Ranking	VDI	Ranking	2005/2000
São Paulo	0,792	1º	0,798	1º	+0,75%
Rio de Janeiro	0,224	4º	0,194	4º	-13,39%
Minas Gerais	0,382	2º	0,238	3º	-37,7%
Holy Spirit	0,355	3º	0,375	**2º**	+5,63%

Source: Elaboration by the authors based on the calculation of the Industrial Density Value for the states of the Southeast

TECHNOLOGICAL DENSITY OF THE STATES OF THE BRAZILIAN SOUTHEAST: 2000/2005.

This section presents indicators that portray the structure and innovative dynamics of the states of the Southeast Region in 2000 and 2005, summarized in Table 4.

It is evident that São Paulo and Rio de Janeiro concentrate innovation activities in the region, leading most of the proxy indicators in the four dimensions analyzed: (A) Government Participation in S&T and R&D; (B) Participation of the private sector in innovation activities; (C) Scientific and Technological Production; and (D) Educational Base and Qualified Human Resources. The exception to this trend is concentrated in dimension (B) – Private sector participation in innovation activities – specifically in indicators B1 and B2. In them, Espírito Santo surpasses Rio de Janeiro and São Paulo in 2000, as well as São Paulo in the B2 indicator in 2005.

2 There is strong evidence that the decline in the VDI observed in Minas Gerais and Rio de Janeiro is related to the loss of competitiveness of traditional sectors of the manufacturing industry in these states, added to a concentrated pattern of industrial growth, with a predominance of the mineral extractive industry.

Table 4 | Synthesis of the Regional Indicators that make up the Technological Density Vector in the States of the Southeast Region of Brazil – Years 2000 and 2005

States	Dimensions of the Technological Density Vector - Year 2000							
	(A)Government Participation in S&T and R&D Activities		(B) Private sector participation in innovation activities		(C) Scientific and Technological Production		(D) Educational Base and Qualified Human Resources	
	Federal and state public spending on S&T and R&D, including spending on education R$/ Inhabitant (A1)	State expenditures on S&T and R&D, in relation to Recipe Total of the State (Part.%) (A2)	Expenditure made by companies in innovative activities in relation to the industry's revenue (Part.%) (B1)	Companies that have made innovations in relation to the total number of companies (Part. %) (B2)	Articles indexed by the ISI in relation to the total number of national articles (Part. %) (C1)	Patents filed with the INPI in relation to the total number of patents filed (Part. %) (C2)	Researchers per million inhabitants (D1)	Professionals engaged in internal R&D activities as a proportion of the personnel employed in the industry (D2)
São Paulo	82,7	1,38%	4,19%	54,6%	48,66%	46,3%	408,5	0,70
Rio de Janeiro	86,65	1,18%	1,53%	46,8%	20,02%	10,6%	510,61	0,43
Minas Gerais	20,17	0,46%	1,15%	47,7%	11,51%	8,0%	243,9	0,19
Holy Spirit	13,93	0,50%	4,59%	63,3%	0,59%	1,35%	141,4	0,57

States	Dimensions of the Technological Density Vector - Year 2005							
	(A)Government Participation in S&T and R&D Activities		(B) Private sector participation in innovation activities		(C) Scientific and Technological Production		(D) Educational Base and Qualified Human Resources	
	Federal and state public spending on S&T and R&D, including spending on education R$/ Inhabitant (A1)	State Expenditures in S&T and R&D in relation to Recipe Total of the State (Part.%) (A2)	Expenditure made by companies in innovative activities in relation to the industry's revenue (Part.%) (B1)	Companies that have made innovations in relation to the total number of companies (Part. %) (B2)	Articles indexed by the ISI in relation to the total number of national articles (Part. %) (C1)	Patents filed with the INPI in relation to the total number of patents filed (Part. %) (C2)	Researchers per million inhabitants (D1)	Professionals engaged in internal R&D activities as a proportion of the personnel employed in the industry (D2)
São Paulo	102,2	1,02 %	3,45%	58,1%	48,66%	44,5%	619,4	0,73
Rio de Janeiro	96,7	0,61%	1,47%	55,6%	20,02%	8,6%	732,14	0,52
Minas Gerais	22,1	0,61%	3,03%	52,4%	11,51%	8,3%	398,6	0,19
Holy Spirit	12,1	0,16%	2,9%	58,6%	0,59%	1,3%	227,6	027

Source: Prepared by the authors based on data from IBGE, Ministry of Science and Technology (MCT), National Institute of Industrial Property (INPI), PINTEC, PIA and Rocha e Faria (2004).

Year 2000: A-1, A2: MCT; B1: PINTEC (2000); B2: PINTEC (1998-2000) and PIA; C1: Rocha and Faria (2004); C2: INPI; D1: MCT and IBGE (2000); D2: PINTEC and PIA (2003). **Year 2005:** A-1: MCT (2003, includes higher education) and estimated population (2005); A2: MCT (2003); B1: PINTEC (2005); B2: PINTEC (2003-2005) and PIA; C1: Rocha and Faria (2004); C2: INPI (2005); D1: MCT (2004) and IBGE (2000); D2: PINTEC and PIA (2005).

Two other observations that deserve to be highlighted in Table 4: i) the concentration of public investments by federal government and state governments in S&T and R&D carried out in São Paulo and Rio de Janeiro in 2000 and 2005 is highlighted, which represent more than three times the investments made in Espírito Santo and Minas Gerais; and ii) in Dimension (D) - Educational Base and Qualified Human Resources, proxy indicator researchers/1,000,000 inhabitants, Rio de Janeiro surpasses São Paulo in 2000 and 2005.

Table 5 presents the calculation of the Technological Density Vectors (VDT) for the states of the Southeast Region in the years 2000 and 2005. Stability in the ranking of technological density is observed in the period analyzed, with São Paulo occupying the first position, followed by Rio de Janeiro, Minas Gerais, and Espírito Santo. The expressive leadership of São Paulo and Rio de Janeiro stands out, evidenced by the values of their respective VDTs, in comparison with the other states. In 2000, the VDT of São Paulo was 0.796, while Rio de Janeiro, Minas Gerais, and Espírito Santo registered, respectively, 0.497, 0.224, and 0.223.

Despite the fourth overall position, the proximity between the technological density of Espírito Santo and that of Minas Gerais in 2000 is noted, evidencing the relevance of the private sector in Espírito Santo in the innovation process. According to Table 5 (Dimension: participation of private companies in innovation), Espírito Santo surpassed the other states in the proxy indicator B2 in the years 2000 and 2005. Finally, it is verified that all the states of the Southeast Region showed growth in their technological densities in 2005, with the following indexes: São Paulo (0.962), Rio de Janeiro (0.521), Minas Gerais (0.269) and Espírito Santo (0.233).

In this context, the performance of the state of São Paulo stands out, which significantly increased its advantage in relation to the other federative units. In 2005, the technological density of São Paulo reached almost double the level recorded by Rio de Janeiro and exceeded by more than three times the rates reached by Minas Gerais and Espírito Santo.

Table 5 | Indicator Indexes, Synthetic Indices and Technological Density -Vector for the states of the Southeast Region of Brazil – Years 2000 and 2005

States	Indicator, Synthetic Index and Technological Density Vector - Year 2000													
	Government Participation in S&T and R&D Activities			Private sector participation in innovation activities			Scientific and Technological Productions			Educational Base and Qualified Human Resources			Technological Density Vector	
	Table of Contents Indicator		Table of Contents Sintét.	Table of Contents Indicator		Table of Contents Sintét.	Table of Contents Indicator		Table of Contents Sintét.	Table of Contents Indicator		Table of Contents Sintét.	VDT	Ranking
	A_1	A_2		B_1	B_2		C_1	C_2		D_1	D_2			
São Paulo	0,946	1,000	**0,973**	0,884	0,464	**0,674**	1,000	1,000	**1,000**	0,723	1,000	**0,536**	**0,796**	**1st**
Rio de Janeiro	1,000	0,783	**0,892**	0,110	0,000	**0,055**	0,404	0,206	**0,305**	1,000	0,471	**0,736**	**0,497**	**2nd**
Minas Gerais	0,086	0,000	**0,043**	1,000	0,054	**0,527**	0,227	0,148	**0,188**	0,278	0,000	**0,139**	**0,224**	**3rd**
Holy Spirit	0,000	0,043	**0,022**	0,000	1,000	**0,5000**	0,000	0,000	**0,000**	0,000	0,745	**0,373**	**0,223**	**4th**
	Indicator, Synthetic Index and Vector Technological Density - Year 2005													
States	Government Participation in S&T and R&D Activities			Private sector participation in innovation activities			Scientific and Technological Productions			Educational Base and Qualified Human Resources			Technological Density Vector	
	Table of Contents Indicator		Table of Contents Sintét.	Table of Contents Indicator		Table of Contents Sintét.	Table of Contents Indicator		Table of Contents Sintét.	Table of Contents Indicator		Table of Contents Sintét.	VDT	Ranking
	A_1	A_2		B_1	B_2		C_1	C_2		D_1	D_2			
São Paulo	1,000	1,000	**1,000**	1,000	0,919	**0,960**	1,000	1,000	**1,000**	0,777	1,000	**0,889**	**0,962**	**1st**
Rio de Janeiro	0,939	0,523	**0,731**	0,000	0,516	**0,258**	0,404	0,169	**0,287**	1,000	0,611	**0,806**	**0,521**	**2nd**
Minas Gerais	0,111	0,523	**0,317**	0,783	0,000	**0,392**	0,227	0,162	**0,195**	0,339	0,000	**0,170**	**0,269**	**3rd**
Holy Spirit	0,000	0,000	**0,000**	0,712	1,000	**0,856**	0,000	0,000	**0,000**	0,000	0,148	**0,074**	**0,233**	**4th**

Source: Prepared by the authors based on data from IBGE, Ministry of Science and Technology (MCT), National Institute of Industrial Property (INPI), PINTEC, PIA and Rocha e Faria (2004).

A1 (Public Expenditure Intensity): State (Ge) and federal (Gf) expenditures on ST&I per inhabitant, based on MCT data. **A2 (State Effort):** Proportion of state expenditures on ST&I (Ge) in relation to the total revenue of the state (Rect. e), according to the MCT.**B1 (Innovative Intensity):** Expenditure of innovative companies in innovation activities in relation to the industry's net sales revenue, based on PINTEC/IBGE.**B2 (Innovation Rate):** Percentage of companies that carried out innovation over the total number of companies, based on PINTEC/IBGE.**C1 (Scientific Production):** Proportion of scientific articles indexed in the ISI database produced by residents of the state in relation to the national total (Art Br), based on Rocha and Faria (2004).**C2 (Technological Production):** Ratio between patents filed by residents in the state and the total number of patents filed by Brazilians with the INPI, according to INPI data.**D1 (Human Resources R&D):** Number of full-time researchers per million population, based on the MCT.**D2 (Human Resources Industry):** Higher education personnel engaged in internal innovation activities over the total number of personnel employed in industry, based on data from the MCT and PIA/IBGE.

Table 6 shows the percentage change in the Vector of Technological Transformation (VDT) in the states of the Brazilian Southeast between 2000 and 2005. There was a generalized growth of the VDT in the region, with a highlight to São Paulo (20.8%) and Minas Gerais (20.4%), whose performances significantly surpassed those of Rio de Janeiro (4.8%) and Espírito Santo (4.4%). The sharp growth of Minas Gerais in the period reflects the joint effort of the public and private sectors to boost the state's technological dynamics. This movement tends to increase the systemic competitiveness of its innovation system, reducing the technological and productive gap in relation to the states of São Paulo and Rio de Janeiro.

Table 6 | Technological Density Vector for the states of the Southeast Region of Brazil, Years 2000 and 2005 - Percentage Change

States	Vector Technology Density-2000		Vector Technological Density-2005		Technological Density Variation
	VDT	Rank	VDT	Ranking	2005/2000
São Paulo	0,796	**1º**	**0,962**	**1º**	+20,8%
Rio de Janeiro	0,497	**2º**	**0,521**	**2º**	+4,8%
Minas Gerais	0,224	3º	**0,269**	**3º**	+20,0%
Holy Spirit	0,223	**4º**	**0,233**	**4º**	+4,4%

Source: Elaboration by the authors

REGIONAL COMPETITIVENESS - MATURITY INDEX OF REGIONAL INNOVATION SYSTEMS FOR THE STATES OF THE BRAZILIAN SOUTHEAST

As discussed in section 1, the Regional Innovation Systems Maturity Index (IMSRI) is used as a *proxy* for the competitiveness/maturity of the states of the Brazilian Southeast, conceived as immature innovation systems (Santos et al., 2004). Table 7 presents the IMSRI for the years 2000 and 2005.

The IMSRI analysis for the states of the Southeast, in the years 2000 and 2005, shows three characteristic elements of immature innovation systems. The first refers to the marked asymmetry between São Paulo and the other Federal Units. With an IMSR of 0.794 in 2000 and 0.880 in 2005, São

Paulo registered a rate more than double that observed in Rio de Janeiro, Minas Gerais, and Espírito Santo in the period. The second element is related to the positioning of Rio de Janeiro, which occupied the second regional position in both years, with indices of 0.361 and 0.358, respectively. Despite having the lowest industrial density in the region (Table 7, column 2), the technological density of Rio de Janeiro is practically double that observed in Minas Gerais and Espírito Santo (Table 7, column 3), a factor that allows its immature innovation system to sustain the regional vice-leadership. Finally, the third element refers to the reconfiguration in the *ranking* of the IMSR between 2000 and 2005, a period in which Minas Gerais was surpassed by Espírito Santo.

Table 7 | Maturity Index of Regional Innovation Systems of the states of the Southeast Region of Brazil - Years 2000 and 2005

Regional Innovation Systems Maturity Index - Year 2000				
States	**Industrial Density Vector 2000**	**Vector Technological Density 2000**	**Regional Innovation Systems Maturity Index (*)**	**Year 2000**
	VDI	VDT	IMSRI	RANKING
São Paulo	**0,792**	**0,796**	**0,794**	1º
Rio de Janeiro	**0,224**	**0,497**	**0,361**	2º
Minas Gerais	**0,382**	**0,224**	**0,303**	3º
Holy Spirit	0,355	0,223	0,289	4º
Regional Innovation Systems Maturity Index - Year 2005				
States	**Industrial Density Vector 2005**	**Vector Technological Density 2005**	**Regional Innovation Systems Maturity Index (*)**	**Year 2005**
	VDI	VDT	IMSRI	RANKING
São Paulo	0,798	**0,962**	**0,880**	1º
Rio de Janeiro	0,194	**0,521**	**0,358**	2º
Minas Gerais	**0,238**	**0,269**	**0,254**	4º
Holy Spirit	0,375	0,233	0,304	3º

Source: Elaboration by the authors

(*) IMSRI Regional Innovation Systems Maturity Index = VDI+VDT/2

Table 8 shows the percentage variations of the IMSRI of the states of the Southeast region in the years 2000 and 2005. It is observed that the state of Rio de Janeiro recorded a decrease of -0.83% in its IMSR, which was attenuated by the favorable position of its technological density. It is noteworthy that the loss of industrial density in Rio de Janeiro in the period was -13.39%.

Table 8 | Percentage variation of the Maturity Index of Regional Innovation Systems of the states of the Southeast Region of Brazil: 2000-2005.

States	Regional Innovation Systems Maturity Index (IMSRI) Year 2000		Regional Innovation Systems Maturity Index (IMSRI) Year 2005		Variation IMSRI 2005/2000
	Value	Rank	Value	Rank	2005/2000
São Paulo	**0,794**	1º	**0,880**	1º	10,83%
Rio de Janeiro	**0,361**	2º	**0,358**	2º	-0,83%
Minas Gerais	**0,303**	3º	**0,254**	4º	-16,17%
Holy Spirit	**0,289**	4º	**0,304**	3º	5,19%

Source: Elaboration by the authors

Minas Gerais, on the other hand, recorded a drop of 16.17% in its IMSRI, mainly due to the negative impact resulting from the reduction in its industrial density, which was -37.7% in the period, see Table 3. In turn, São Paulo increases its IMSRI by 10.83% and Espírito Santo by 5.19%, which contributes to the strengthening of its immature innovation systems, enabling them greater regional competitiveness and more sustainable economic development.

FINAL THOUGHTS

Between 1930 and 1980, the Brazilian State promoted the industrialization of the country, resulting in significant growth rates of GDP and per capita income. The process of industrialization by import substitution was concentrated in the Southeast Region of Brazil, which began to account for a significant contribution to Brazilian industrial production, with the region participating with 63.5% of the national VTI in 2005 (IBGE, 2007). Studies carried out by authors such as Bresser Pereira and Marconi (2008), Oreiro and Feijó (2010) indicate that neoliberal policies would have contributed to the occurrence of processes of deindustrialization and reprimarization in the Brazilian economy.

Seeking to verify the above hypothesis, the research aimed to analyze the impact of the neoliberal policies implemented in Brazil, from 1994 onwards, on the evolution of the industrial and technological densities of the Southeast Region, as well as on the degree of maturity (competitiveness) of its industrial structures and Science and Technology and Research and Development (S&T) and (R&D). The analysis included the years 2000 and 2005, when neoliberal policies were already showing their results in the country.

Based on the theoretical framework of Regional Innovation Systems and the methodological framework proposed by Rosendo (2008), based on Rocha and Ferreira (2004) and Desai et al. (2002), indicators of industrial density (Industrial Density Vector - VDI) and technological density (Technological Density Vector - VDT) were defined, as well as an indicator composed of the average of the two indicators above defined as the Maturity Index of Regional Innovation Systems - IMSRI.

From the methodology adopted, it was observed that the neoliberal policies implemented from 1994 onwards, particularly in the governments of Fernando Henrique I and II (1995 to 2003), contributed to intensify processes of deindustrialization and reprimarization in the Southeast Region of Brazil. The most direct and intense impacts of this process occur negatively in the states of Rio de Janeiro and Minas Gerais. Considering the period 2000-2005, the industrial density of Rio de Janeiro is reduced by -13.39%, and this process is even more severe in Minas Gerais, whose industrial density decreases by -37.7%.

As a result of the structural opening of the economy, the appreciated exchange rate and high interest rates, many small and medium-sized national companies stopped operating in the regional market, which negatively impacted the manufacturing industry of these states. This process is followed by an increase in industrial concentration. In this sense, considering the participation of the three largest sectors in the total VTI of each state, the percentage increase in industrial concentration in the period 2000-2005 was as follows: Minas Gerais (23.7%), São Paulo (21.4%), Rio de Janeiro (9.17%) and Espírito Santo (3.1%) - see Table 1.

As for the Industrial Density (VDI) ranking of 2005, the state of São Paulo took the lead with an index of (VDI=0.798), representing more than twice the number of other states in the Southeast. Espírito Santo was in second place (VDI=0.375), surpassing Minas Gerais, which registered the third place (VDI=0.238). Rio de Janeiro, in turn, had the lowest performance among the states of the Southeast, with a VDI of 0.194, evidence of the fragility of its manufacturing industry in the period analyzed.

In relation to Technological Density (TD), there is a concentration of innovative capacities in the Southeast in São Paulo and Rio de Janeiro, when compared to those of the states of Minas Gerais and Espírito Santo. The S&T and R&D infrastructures of the state of Rio de Janeiro, for example, are tributaries of the historical concentration of teaching and research institutions — which began with the arrival of the Royal Family in 1808 — and of its condition as a strategic headquarters for state-owned companies, such as Petrobras, during the period in which it was the capital of Brazil. São Paulo's protagonism, on the other hand, is based on a robust industrial base articulated with a dense infrastructure of Research and Development (R&D) and Science and Technology (S&T), with significant performance by state institutions. The 2005 Technological Density ranking ratifies this hierarchy: São Paulo leads with (VDT=0.962), followed by Rio de Janeiro (VDT=0.521), Minas Gerais (VDT=0.269) and Espírito Santo (VDT=0.233).

The IMSRI measures each state's innovation maturity and competitiveness as the average of the Industrial and Technological Density Vectors. According to the analysis developed, the states of the Southeast region are characterized as immature or incomplete innovation systems. High IMSRI values, i.e., close to 1, correlate with a greater capacity for adaptation and technological production, giving greater competitiveness to the industry of more sophisticated goods. The IMSRI ranking, referring to 2005, shows the leadership of São Paulo: 1st place (IMSRI=0.880), followed by Rio de

Janeiro: 2nd place (IMSRI=0.388), Espírito Santo: 3rd place (IMSRI=0.304), and Minas Gerais: 4th place (IMSRI=0.254). It is noteworthy that the state of Espírito Santo surpasses Minas Gerais, since it was in 4th place in 2000, moving to 3rd. Position in 2005. In the period 2000-2005, São Paulo and Espírito Santo showed growth in the IMSRI of 10.83% and 5.10%, respectively, while Minas Gerais and Rio de Janeiro showed a reduction in this indicator of -16.13% and -0.83%.

Minas Gerais recorded a considerable reduction in its IMSRI between 2000 and 2005, due to the intense drop in its industrial density in the period, which resulted in the loss of the third position to Espírito Santo and the last place in the *ranking*.

Therefore, the indicators reveal that Minas Gerais is the state most affected in the Southeast by neoliberal policies, showing more intensely the occurrence of deindustrialization and reprimarization processes in this state, with emphasis on the expansion of the mineral extractive industry and agroindustry, in contrast to the regression of the traditional sectors of the manufacturing industry.

Rio de Janeiro also showed a significant drop in its industrial density in the period 2000-2005. However, its expressive infrastructure in S&T and R&D ensures that the state of Rio de Janeiro is in the second position in regional competitiveness. Nevertheless, the accelerated process of deindustrialization that is observed in Rio de Janeiro reflects the degradation of the traditional manufacturing industry and the reprimarization of its productive activities, especially the oil extractive industry.

Espírito Santo stands out for having a diversified and dynamic production structure, based on the export agro-industry and the mineral extractive industry. Its manufacturing industry is still incipient compared to the other states of the Southeast. For this reason, neoliberal policies are well absorbed by the state, which takes advantage of the expansive cycle in these segments to improve the innovative capacity of its system, increasing the degree of processing of its commodities and, consequently, the added value to it. These elements help to explain the positive evolution of the IMSR of Espírito Santo by 5.8% in relation to the year 2000, and reaching the 3rd place in the hierarchy of the states of the Southeast in 2005. Such positive impacts help explain the promising cycle of economic development in this state.

Given the robustness of its innovation system, São Paulo demonstrates greater resilience to the effects of neoliberal policies, appropriating part of the losses of the other federative entities in the Southeast, which allows it to advance 10.8% in its IMSRI in the period 2000-2005 (see Table 8). However, this result does not mean that the state "has not suffered" the effects of neoliberal policies on its industry. As shown in Table 1 - Synthesis of industrial indicators, industrial production dimension, the share of the VTI of São Paulo in relation to the national VTI changed from 44.8% in 2000 to 40.21% in 2005. This downward trend will continue throughout the 2010s and 2020s, indicating the dispersion of São Paulo's industry - especially the traditional manufacturing industry - to other states and a reduction in the number of companies associated with industrial concentration and bankruptcies. The growth of São Paulo's agro-industry and mineral extraction reflects the region's economic reprimarization.

Highlighting the limitations of the IMSRI model, such as, for example, that it does not cover the quality and interaction of institutions and that it fundamentally captures the impacts of the variables only in the group of actors that make up the analysis, the methodological approach corroborates the hypothesis that "neoliberal policies negatively affected the Southeast Region, by having contributed to its deindustrialization and reprimarization in the period 2000-2005".

Finally, returning to Friedrich List's perspective, the importance of industrial policies and active S&T and R&D policies is emphasized, in a systemic approach, to shape the immature innovation systems of Brazilian states, both at the federal and state levels, as a strategy to boost regional and national economic development.

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